NOAA TIME Center Report:

FY2004 TIME Progress

FY2004 State Progress

FY2005 TIME Center Plans

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FY2004 TIME Progress

The NOAA TIME Center continues to support NTHMP Modeling and Mapping Program goals. This report summarizes progress in FY2004 and plans for FY2005. The following activities supported and contributed to both State and NTHMP Modeling and Mapping goals:

Development of merged bathy/topo computational grids

- 24 grids were developed or upgraded:

Site	Type	Grids
Kodiak, AK	Upgrade	3
Northern CA	New	9
Crescent City, CA	New	2
Humboldt Bay, CA	New	1
Newport, OR	Upgrade	3
Seaside, OR	New	3
Tacoma, WA	Upgrade	3

In addition:

- Long Beach-Ocean Shores, WA and Warrenton-Astoria, OR, grids are under review.

- Prince William Sound, AK. A tidal datum distribution analysis is underway, with assistance from the Ocean Prediction Experimental Laboratory of the University of Miami. This study is needed for future grid development.

- Sand Point, AK. (a) Preliminary LIDAR data has been received from the National Ocean Service and is being analyzed for future grid development. (b) Multibeam surveys were conducted by NOS in this area in the summer of 2004, and the preliminary data will be sent to TIME as soon as the data are processed.

- Sitka, AK. Multibeam data collected by NOS will be sent to TIME as soon as the data are processed. NOS continues to work on reducing processing delays.

- N. Oahu, N. Kauai, and Hilo Bay, HI. Data analyses and recommendations have been provided to UH-Manoa for use in their two-dimensional modeling efforts.

Infrastructure Development

- Mapping and Modeling Subcommittee. Organized and began the work of this committee by e-mail and telephone. Conducted first committee meeting on 2 November 2004.

- Tool development. Data archival and modeler communication capabilities have been developed for the PMEL computational environment known as the Facility for Analysis and Comparison of Tsunami Simulations (FACTS).

- MOST/FACTS upgrades and transfers. Transfers are underway of the FACTS system and the latest version of the MOST model, including stability enhancements and variable friction factors, to

    • University of Southern California (USC),
    • University of Hawaii-Manoa (UH)

- Grids and GIS inventory. Grids and associated GIS datasets have been transferred to an in-house online inventory for future distribution and analysis

- DART de-tiding software. A program for detiding tsunameter water levels has been developed, tested and transferred to NDBC.

Data Rescue

- Oregon grids and animations. TIME has transferred some products from prior mapping efforts to DOGAMI. Similar products from earlier Oregon efforts (1997-2000) are also being pulled from archives for transfer to DOGAMI

- Deep ocean pressure data and tide gage data. TIME has created an inventory of historical data, including fifteen years of bottom pressure data from archaic systems.

Contributions to Modeling/Mapping meetings and workshops

- 14 September 2004. WA-DNR/TIME/USGS Meeting on Earthquake Source Scenarios for Tacoma, Washington. Pacific Marine Environmental Laboratory, Seattle, WA.

- 16 September 2004. Northwest Regional Coordination Meeting, NOAA/Western Regional Center, Seattle, WA.

Publications and Presentations in support of NTHMP Modeling and Mapping Goals

Publications

González, F.I., V.V. Titov, H.O. Mofjeld, A. Venturato, S. Simmons, R. Hansen, R. Combellick, R. Eisner, D. Hoirup, B. Yanagi, S. Yong, M. Darienzo, G. Priest, G. Crawford, and T. Walsh (2004): Progress in NTHMP hazard assessment. U.S. National Tsunami Hazard Mitigation Program Special Edition, Nat. Hazards [In press].

Hebenstreit, J., F.I. González, and J. Preuss (2003): Tsunami impact and mitigation in inhabited areas. In Earth Science in the City: A Reader, G. Heiken, R. Fakundiny, and J. Sutter (eds.), American Geophysical Union, Washington, 171–186.

Mofjeld, H.O., A.J. Venturato, F.I. González, and V.V. Titov (2004): Background tides and sea level variations at Seaside, Oregon. *NOAA Tech. Memo*. OAR-PMEL-126, 15pp.

Mofjeld, H.O., A.J. Venturato, F.I. González, V.V. Titov, and J.C. Newman (2004): The harmonic constant datum method: Options for overcoming datum discontinuities at mixed-diurnal tidal transitions. J. Atmos. Ocean. Tech., 21, 95–104.

Venturato, A.J., V.V. Titov, H.O. Mofjeld, and F.I. González (2004): NOAA TIME Eastern Strait of Juan de Fuca Tsunami Mapping Project: Procedures, data sources, and products. *NOAA Tech. Memo*. OAR PMEL-127, 26 pp.

Walsh, T.J., V.V. Titov, A.J. Venturato, H.O. Mofjeld, and F.I. González (2004): Tsunami hazard map of the Bellingham area, Washington – Modeled tsunami inundation from a Cascadia subduction zone earthquake. Washington Division of Geology and Earth Resources Open-File Report 2004-15, 40x36 in. color sheet, scale 1:50,000.

Presentations

Venturato, A.: Using GIS for Tsunami Hazard Assessment. Coastal Geographic Information Systems Workshop, University of Hawaii, 13-15 November 2003.

González, F.I.: The National Tsunami Hazard Mitigation Program and Tsunami Hazard Modeling and Mapping. FEMA Coastal Study Workshop 1, Sacramento, CA, 2-4 December 2003.

González, F.I., V.V. Titov, H.O. Mofjeld, J.C. Newman, A.J. Venturato and M.C. Eble: Forecasting Tsunami Impacts on Coastal Communities. 2004 AMS Meeting, Interactive Symposium on the Nexus of Coastal Urban Environments, Seattle, Washington, 14 January 2004.

González, F.I.: Inundation Modeling & Mapping Practices and Procedures. FEMA SCO-SHMO Meeting, Bothell, Washiington, 28 January 2004.

González, F.I.: Aspects of the U.S. National Tsunami Hazard Mitigation Program Relevant to the FEMA FIRM Update Program. FEMA FIRM Workshop #2, Sacramento, CA, 25 February 2004.

Bernard, E. and F.I. González: Tsunami Inundation Forecasting & Mapping. Tsunami Coordination Meeting, Honolulu, Hawaii, 2-4 March 2004

González, F.I.: Tsunami Modeling. Earthquake Workshop for Tribes, Ocean Shores, Washington, 21-22 June 2004

Borrero, J C., Gonzalez, F I., Titov, V V., Newman, J C., Venturato, A J., Legg, G: Application of FACTS as a tool for modeling, archiving and sharing tsunami simulation results. Fall AGU, San Francisco, California, 13-17 December 2004.

Mofjeld, H. O., Venturato, A. J.,Gonzalez, F. I., Titov, V. V.: Effects of the Tides on the Probability of Tsunami Inundation at Seaside, Oregon. Fall AGU, San Francisco, California, 13-17 December 2004.

Titov, V V., Arcas, D., Kanoglu, U., Newman, J.,Gonzalez, F I: Inundation Modeling for Probabilistic Tsunami Hazard Assessment. Fall AGU, San Francisco, California, 13-17 December 2004.

Yalciner, A C., Kanoglu, U., Titov, V: Quantifying Tsunami Impact on Structures. Fall AGU, San Francisco, California, 13-17 December 2004.

FY2004 State Progress

(*Summarized from State Reports in Appendix)*

Alaska

- The Alaska Tsunami Mapping Team (ATMT) has completed inundation maps for Homer-Seldovia, AK. These maps are currently under review.
- ATMT continues to work on modeling simulations for Seward, including submarine landslide scenarios based on morphology of recent NOS multibeam bathymetric data
- A 3D numerical model for wave generation by underwater landslides continues to be developed.

California

- Completed coarse-grid modeling for most of coast south of the Golden Gate.
- Modeling scenarios for central and northern California continue to be developed.
- USC is working with the new FACTS node and MOST code to rebuild its database of inundation runs for southern California.
- Planning is underway for California Tsunami Source Workshop

Hawaii

- UH has divided Hawaiian coastlines into 28 segments for 2D modeling.
- A bathymetric and topographic database for the Hawaiian region has been compiled.
- Seismic source parameters, tide gage records, and observations of all major tsunamis affecting Hawaii in the past 100 years have been compiled.
- Developed draft procedure for inundation map production using the Oahu North Shore.
- Established FACTS node to facilitate collaboration with PMEL and TWCs.
- Initiated MOST model implementation
- Initiated integration of UH finite volume model into FACTS

Oregon

- The Oregon Graduate Institute (OGI) is finishing simulations of Florence. DOGAMI has produced initial inundation maps and presented them to local officials. Final inundation maps should be published this winter.
- DOGAMI is collecting bathymetric and topographic data for the Pacific City area. Bathymetric surveys for the Nestucca river were conducted in August 2004.
- DOGAMI is cooperating with TIME and USGS on tsunami modeling of Seaside for the FEMA flood mapping program.

Washington

- The Eastern Strait of Juan de Fuca project has been completed with the publication of a Bellingham tsunami hazard map, an Anacortes and Whidbey Island tsunami hazard map [under review], and a NOAA Technical Memorandum on modeling and procedures.
- The Washington Modeling and Mapping group held a meeting with Tom Brocher, Tom Pratt, and Craig Weaver of the U.S. Geological Survey to discuss Tacoma tsunami sources. This fall, Brocher, Pratt, and Sherrod will provide fault parameters for earthquake source scenarios.

FY2005 TIME Center Core Plan

Goal: Support State Modeling and Mapping Programs.

Development of Merged Bathy/Topo Computational Grids

- 20 digital elevation models (DEMs) will be developed or upgraded for computational grids, including data acquisition, quality control and associated tidal and datum analyses.

Site	Type	Grids
Alaska		
Prince William Sound & Whittier, AK	Tidal analysis; grids	5
Sitka, AK	Data and grid update	2
California		
CA-OR border region	Data and grids	3
Deep ocean, CA	New grids	4
Hawaii		
Nawiliwili, HI	Data, analyses, and grids	3
Oregon		
Cannon Beach, OR	Data and analyses	
Warrenton-Astoria, OR	Data and grids	3

Budget. Funding of $190K is requested to cover 1.8 full time equivalent (FTE) personnel and related expenses.

Item	*Mo*	$K
Director	*1.0*	$19.0
Senior Scientist	*2.0*	$37.6
Modeler	*2.0*	$18.0
DEM/GIS Expert	*6.0*	$42.3
Scientific Programmer	*3.0*	$22.1
Student Assistant	*8.0*	$25.7
Computer Time		$15.0
Hardware, Software		$5.0
Travel		$5.0
Total	*22.0*	**$190.0**

FY2005 TIME Center Enhanced Plan

Goal: Enhanced Support of State Modeling and Mapping Programs.

Development of Merged Bathy/Topo Computational Grids

- 14 additional bathy/topo grids will be developed or upgraded, through data acquisition, quality control and associated tidal and datum analyses.

Site	Type	Grids
Alaska		
Sand Point	Analysis	3
California		
CA-Mexico border region	Data, analysis and grids	3
San Pedro and Los Angeles Harbor	New grids	3
Hawaii		
Select Hawaiian coastal segments (28)	Data, analysis, and grids	3
Washington		
Port Angeles, WA	Grid update	2

Infrastructure Development

- Mapping and Modeling Subcommittee. Continue to lead the work of this committee on important issues of standardization, quality control, model and map certification, and technology transfer address NTHMP Modeling and Mapping Program goals.
- Tool development. Continue FACTS and other tool development efforts to improve modeler collaboration, analyses, and data archival capabilities.
- MOST/FACTS upgrades and transfers. Complete transfer of FACTS and latest version of MOST model, including stability enhancements and variable friction factors, to:
    - University of Southern California (USC),
    - University of Hawaii-Manoa (UH)
- Grids and GIS inventory. Continue to develop in-house online inventory
- DART support. Continue to coordinate with NDBC, PMEL EDD, WCATC and PTWC on DART issues – trouble-shooting, network design, data stream, tide removal, etc.

Data Rescue

- Continue to search for Oregon grids and animations and transfer files to DOGAMI.
- Continue development of inventory of historical deep ocean pressure and tide gage data.

Continue contributions to Modeling/Mapping meetings and workshops

Continue Publishing and Presenting in support of NTHMP Modeling and Mapping goals

Budget. Funding of $262.5K is requested to cover 2.4 full time equivalent (FTE) personnel and related expenses.

Item	*Mo*	$K
Director	*1.0*	$19.0
Sr. Scientist	*4.0*	$75.8
Modeler	*3.0*	$27.0
DEM/GIS Expert	*9.0*	$64.4
Scientific Programmer	*3.0*	$22.2
Student Assistant	*9.0*	$29.2
Computer Time		$15.0
Hardware, Software		$5.0
Travel		$5.0
Total	*29.0*	**$262.5**

Appendix: State Reports

Alaska Tsunami Inundation Mapping Project

Roger Hansen, PI ***NOAA Goal 1, (4)***
University of Alaska Fairbanks

Other investigators/professionals funded by this project:
Elena Suleimani and Duncan Marriott, University of Alaska Fairbanks
Rod Combellick, State of Alaska Division of Geological and Geophysical Surveys

This project is ongoing.

Primary objectives and approach

The Geophysical Institute/Alaska Earthquake Information Center participates in the National Tsunami Hazard Mitigation Program (NTHMP) by evaluating and mapping potential inundation of selected parts of Alaska coastlines using numerical modeling of tsunami wave dynamics. The communities are selected for inundation modeling in coordination with the Division of Homeland Security and Emergency Management (DHSEM) with consideration to location, infrastructure, availability and quality of bathymetric and topographic data, and community involvement. Kachemak Bay and Prince William Sound are high-priority regions for Alaska inundation mapping. They have several communities with significant population and extensive fishing resources (Homer, Seldovia, Seward, Valdez). Emergency managers need tsunami evacuation maps for these communities, showing the extent of inundation with respect to human and cultural features, and evacuation routes.

Research accomplishments/highlights/findings

- We have completed inundation modeling and mapping for the communities of Homer and Seldovia in Kachemak Bay, Alaska. The report (see Publications) is currently in the review process. It includes tsunami hazard maps for Homer and Seldovia that show the extent of inundation resulting from the "worst case scenario," which is the maximum inundation of the modeled scenarios. It also includes inundation maps that present inundation lines calculated for two different hypothetical tsunami scenarios. Numerical simulations yield runup heights, depths of inundation on dry land, and maximum velocities in the inundation zones.
- We continue to work on the Seward inundation mapping project. We performed numerical calculations for three of the six hypothetical tsunami scenarios in Resurrection Bay. The results show that the destructive waves of the 1964 Alaska tsunami in Seward were generated by the sea floor displacements in the Prince William Sound asperity of the 1964 rupture zone.
- We obtained the raw, high-resolution multi-beam bathymetry data from the 2002 NOAA survey of Resurrection Bay, with a grid spacing of approximately 4.5 meters. This dataset had many holes and did not reach to the coastline. To create a smooth surface for bathymetry analysis, we created a tin using these elevations points along with a high-resolution coastline to interpolate and fill the regions of no data. Using this dataset, we created a smooth surface model of the seafloor in order to inspect the current morphology for evidence of past submarine landslides. To facilitate close analysis of the regions of interest, small subsections of the resulting grid adjacent to the coastline were clipped out and used to make detailed shaded three-dimensional relief plots for visual inspection. These regions included the coastal areas stretching from south of Lowell Point around Resurrection Bay to south of Fourth of July Creek.
- We have begun to examine submarine landslide features in Resurrection Bay near Seward, Alaska. We have studied 3D bottom topography near Seward, and identified features suggesting that a small part of the seaward portion of the post-glacial delta underlying Seward collapsed during the 1964 earthquake, generating a tsunami. Our preliminary work shows that we can identify the scarp and the extent of the submarine slide from the DEM image. We have also identified several smaller slide scarps near the large slide, suggesting the tsunami generation mechanism was complex and involved more than one submarine slide.
- We continue to work on the 3-D numerical model for the waves generated by underwater landslides, expanding the model to include the subaerial component of the landslide.

NOAA relevance/societal benefits

These activities all pertain to the National Tsunami Hazard Mitigation Program with NOAA's Weather Service.

Research linkages/partnerships/collaborators and networking

Collaborations for this work include the Alaska Division of Geological and Geophysical Surveys, the Alaska Department of Emergency Services, the Alaska Tsunami Warning Center, and the Pacific Marine Environmental Laboratory of NOAA in Seattle.

Education/outreach

- Investigators visited Alaska communities in cooperation with the NOAA tsunami warning center and the Alaska State Emergency Services offices.
- Results of this work form much of the basis for the award-winning video *Ocean Fury: Tsunamis in Alaska,* produced in spring 2004 by Alaska Sea Grant with the Alaska Earthquake Information Center and the Alaska Division of Homeland Security and Emergency Management.

Publications

Suleimani, E.N., R.A. Combellick, D. Marriott, R.A. Hansen, A.J. Venturato and J.C. Newman. Tsunami Hazard Maps of the Homer and Seldovia areas, Alaska. Alaska Division of Geological and Geophysical Surveys Report of Investigations. In the review process.

California Tsunami Risk Assessment Effort (DRAFT 10/27/04)

Progress on Modeling

Modeling (course grid) and mapping has been completed for most of the coast south of the Golden Gate. Modeling has been initiated for jurisdictions to the north. The contractor reports that he as completed the 3-second bathymetry grids for the entire coastline in a GIS format and has developed a system to extract data for creation of computational grids.

Grid runs have been set up for northern California and they are scheduled to be run inn the near future.

Progress on the meta-data project continues with the creation of a FACTS system node on a University of Southern California computer. All future runs will be stored in a common data format, internet accessible, for use. MOST has been set up to run FACTS data stored on the NOAA servers.

Upgrading and Changes

Improvements to software and new computer systems have required USC to recomputed inundation runs for southern California. The adoption of the NOAA/MOST version of the seismic deformation code has required training in the procedures for locating the sources using the new software. This has required extensive work in relocating and recomputing fault units and verification of location. In addition, runs previously produced using Southern California Bight needed to re recomputed and stored in the new database system.

Priorities for Future Funding

Priorities for the State of California are, for coarse grid analysis, northern California from Monterey Bay to the Oregon Border for a Cascadia subduction event, with more detailed analyses as available for San Francisco Bay, Monterey Bay and Humboldt Bay; for fine grid analysis, we will begin detailed modeling for LA harbor first then Humboldt Bay (this may already be available), Newport Bay, San Diego/Mission Bays, Dana Point and Oceanside.

Status Report of Tsunami Source Workshop

The planning for the NOAA supported California Tsunami Source Workshop is underway, with CGS taking the lead. The workshop agenda will include identification of near shore seismic sources in southern and central California, and the potential tsunami inundation from a M9 Cascadia Subduction Zone earthquake in northern and central California.

Hawaii NTHMP Progress

The State of Hawaii officially began the efforts to update its tsunami evacuation maps in 2004. The existing maps, which cover 450 miles of coastlines, were developed in 1991 using a 1D model. The map update will incorporate latest 2D modeling techniques, demographic and economic data, and Geographical Information System (GIS) technology. Hawaii State Civil Defense Division convened a team of engineers, researchers, and emergency managers from the University of Hawaii (UH), Department Land and Natural Resources (DLNR), and Pacific Disaster Center (PDC) to carry out the tasks. This project will capitalize on PDC's extensive experience with GIS and related data and map products. UH is responsible for overall project management as well as the modeling and data analysis work that leads to the development of inundation maps. UH also works with PDC to produce demographic and economic data associated with tsunami evacuation. DLNR evaluates, revises, and approves the inundation maps produced by UH and uses the map and data products as well as input from state and county civil defense agencies to update the evacuation maps.

The methodology for inundation map development is distinct from that adopted by other states under NTHMP. Hawaii has well-documented runup data along its coastlines for major tsunamis from the Japan-Kuril-Kamchatka, Aleutian-Alaska, and Peru-Chile sources over the last 100 years. Previous studies on seismic and geodetic data have established the source parameters of these events. A 2D model can calculate tsunami generation at the source, propagation across the Pacific, and runup along a stretch of Hawaii coastline through a multi-level nested grid. However, experience has indicated that numerical solutions accrue errors through idealization and approximations of these physical processes and don't necessarily reproduce the recorded runup even with the best available seismic source parameters. The present approach limits these modeling errors to be near the source by adjusting the slip (source strength), even beyond its reasonable range if necessary, to match the computed results with the recorded runup. Implementation of this procedure for all major historical events over the last 100 years reproduces the corresponding inundation limits. The landward envelope of the computed results defines the 100-year inundation limit and statistical analysis of the data will provide the 200-year inundation limit. The inundation map, which will include both the 100-year and 200-year inundation limits, provides the basis for evacuation map development. The present approach follows and enhances the concepts used in the production of the existing evacuation maps by using a 2D model covering the Pacific.

The progress during the period January - October 2004 is summarized below.

- Divided the Hawaii coastlines into 28 segments of typically 40 to 50 km long. Each segment, which is determined based on 2D modeling considerations, is bounded by headlands or cliffs that naturally divide the incoming flood water.
    - Gathered general demographic and economic data for the 28 segments and performed preliminary risk assessment.
    - Began consultation with county civil defense agencies to determine priority of the 28 segments.

- Compiled a bathymetry and topography database using ArcGIS 9.0. The sources include the GEBCO 1' and ETOPO2 data over the entire globe, USGS I-2809 5" data for the Hawaii region (199°E 17°N to 206°E 24°N), SHOALS data at 3-m resolution in Hawaii coastal waters, and the USGS DEM data at 10-m resolution on land (Hawaii). The database still needs better topographic data near the coastlines to be viable.
  - Converted the reference of the datasets to the WGS 84 datum and the mean-sea level and performed quality control.
  - Implemented the Generic Mapping Tool (GMT) to generate multi-level nested grids from the database.
- Compiled seismic source parameters, runup and tide gauge records, and eyewitness accounts for all major tsunamis that affected Hawaii over the last 100 years. These include the 1946 Aleutian Tsunami, 1952 Kamchatka Tsunami, 1957 Aleutian Tsunami, 1960 Chile Tsunami, and 1964 Alaska Tsunami.
  - Determined the range of slip for each event that produces reasonable agreement with Hawaii tide gauge records through a 2D model.
- Developed a draft procedure for inundation map production and completed a trial run for one tsunami event for the Oahu North Shore segment (Kaena Point to Kahuku Point). This segment covers three existing evacuation maps.
  - Compiled detailed demographic and economic data for the segment.
  - Conducted GPS surveys and site visits to gather near-shore topographic data and terrain information (roughness coefficient).
  - Verified, refined, and adjusted the near-shore DEM data through comparison with GPS survey data and paper maps.
  - Developed a 4-level nested grid with increasing resolution from 1' to 10 m and computed the inundation limit along the segment using a 2D model.
- Set up a FACTS node at UH to facilitate closer collaboration with NOAA PMEL and tsunami warning centers.
  - Began implementation of the MOST (2D) model for inundation calculation.
  - Began integration of the UH finite volume (2D) model into FACTS.

The project team plans to complete the inundation map for the Oahu North Shore segment and begin development of the corresponding evacuation maps in early 2005. This first inundation map will be developed based on both the PMEL MOST model and the UH finite volume model for calibration purposes. The project team will use the UH model, which is specifically developed for the Hawaii coastal conditions, in subsequent inundation map development.

Oregon

Florence Inundation Map: Oregon Graduate Institute of Science and Technology (OGI) has finished initial simulations for Florence, but is doing some additional simulations to see if grid spacing can be reduced without numerical instabilities becoming an issue. Initial inundation areas have been mapped by DOGAMI and shared with local officials in a meeting and field trip to affected areas in and around Florence. The Florence inundation map should be ready for TIME review in the next 2 months with publication a month or two after that.

Pacific City Inundation Map: DOGAMI is collecting bathymetric and topographic data for grids covering the Pacific City-Nestucca River area. DOGAMI contracted with an Oregon firm to do a bathymetric survey of the Nestucca River in August of 2004. That data has been transmitted to OGI.

Cannon Beach Inundation Map: DOGAMI met with the City of Cannon Beach and made plans to produce an inundation map of the City next year. The City is contributing a detailed topographic map that is being produced this winter through a photogrammetric survey. Production of a tsunami evacuation brochure for Cannon Beach was postponed until the inundation mapping results are available.

TIME Work in Oregon: Data rescue efforts of older model data are underway by TIME. Animations of these older models have been distributed by TIME to DOGAMI and Oregon Emergency Management. TIME is also collecting bathymetric and topographic data for the development of grids covering Warrenton, Astoria, and Seaside. TIME, in cooperation with USGS, is pursuing a study of tsunami sources and potential inundation at Seaside. This project is being sponsored by the FEMA flood mapping program. DOGAMI is cooperating with TIME on all of these projects.

Washington

The Bellingham tsunami hazard map (Walsh et al, 2004) has been published by WA-DNR, and the Anacortes and Whidbey Island tsunami hazard map is in press. A NOAA Technical Memorandum for the Eastern Straits of San Juan de Fuca inundation mapping project is also in press.

The Washington mapping group held a meeting with Tom Brocher, Tom Pratt, and Craig Weaver of the U.S. Geological Survey to discuss Tacoma tsunami sources. Brocher and Pratt will providefault parameters of the most probable earthquake tsunami sources for the Tacoma fault this fall. Grids are being reviewed for Ocean Shores-Long Beach modeling.

Publications

Walsh, T.J., V.V. Titov, A.J. Venturato, H.O. Mofjeld, and F.I. González (2004): Tsunami hazard map of the Bellingham area, Washington — Modeled tsunami inundation from a Cascadia subduction zone earthquake, 40 x 36 in. color sheet, scale 1:50,000, OFR 2004-15.

Walsh, T.J., V.V. Titov, A.J. Venturato, H.O. Mofjeld, and F.I. González: Tsunami hazard map of the Anacortes and Whidbey Island area, Washington—Modeled tsunami inundation from a Cascadia subduction zone earthquake [in press].

Venturato, A.J., V.V. Titov, H.O. Mofjeld, and F.I. González (2004): NOAA TIME eastern Strait of Juan de Fuca, Washington, mapping project: Procedures, data sources, and products. NOAA Tech. Memo. OAR PMEL.